INSPECTION OF GEARS

General

The purpose of gear inspection is to assure the required accuracy and quality of the finished product, and to furnish a means of economically controlling the manufacturing process.

The specified accuracy and quality of a gear is determined by its end use.

Gears that have a degree of accuracy greater than required, increase the cost of manufacture.

Gears that do not have the required degree of accuracy could have one or more of these problems---Noise, Wear, Breakage, Vibration, Inaccuracy of index, Excessive Maintenance, Undue Strain or Wear on other members of the mechanism. (This assumes that the gears are of proper design).

There are several distinct methods of gear inspection. These can be divided into two groups:

1. The Complex Composite Group

   A. Sound Testing
   Running gears at varying speeds loaded and unloaded in special machines. Acceptance or rejection based on sound level.

   B. Angular Velocity Testing
   An excellent concept, but used very little because of the expense involved and incomplete results.

   C. Functional Checking (Gear Rolling)
   The most common and least expensive method in use today, employing variable center distance instruments.

This compostie group does not in some cases reflect all the factors which determine gear success or failure. Also, although they serve a good purpose in the constant control of the output of production machines, they fall short in the economical control of the production process.

2. The Analytical Method

Although it is a single method, it is made up of many individual checks, each separated from the other, as much as possible, allowing interpretation of measurement into the various factors which cause errors.

It is probably well to understand that comparisons between these distinctly different methods are extremely difficult.

The intensity, frequency and resonance of noise, besides its impermanence and lack of standardization is impossible to correlate with functional methods or individual inaccuracy.

Functional center distance change is the result of the composite effect of most individual errors. Because it is a composite, it is difficult to separate center distance into individual dimensional inaccuracies. Besides conditions could exist in which an inaccuracy possibly would not change center distance. Also, the fact that most gears have, to some degree, all of the individual inaccuracies possible, further complicates the interpretation of compostie results.

The A.G.M.A. for the purpose of standardization has divided gears into two broad types.

1. Fine Pitch = 20 Teeth or more per inch of P.D.
2. Coarse Pitch = Less than 20 teeth per inch of P.D.

COARSE PITCH

On coarse pitch gears, because it is more complete, definitive, and gives a better control of production methods, analytical checking is usually the final determination of gear accuracy. Coarse pitch gear methods and tolerances have been analytically standardized by the A.G.M.A. These standards are widely used and accepted.

These standards have made it possible for most production shops to use analytical methods for initial output inspection after any production machine change or set-up, for the continuous checking of a small percentage of all gears produced, and for the experimental research and

design work on new types and products.

Analytical checking, although very practical, because of its nature, is a time consuming operation. Therefore, it is generally backed up by functionally checking a large percent or all of the gears produced.

It is possible in this combination of methods, for a small percentage of gears to pass the functional inspection which would be rejected analytically. However, because of periodic analytical checks, the risk is very small and well calculated.

Small quantity jobs are usually exclusively checked on general purpose analytical machines.

FINE PITCH

Fine Pitch Gears, having small face width, shallow tooth depth, and being predominantly spur type, have in the past been limited to functional inspection methods. Standards of functional methods and inspection tolerances compiled by the A.G.M.A. are available, sufficiently complete, and widely used. The use of analytical checking of fine pitch gears has been neglected, because of the lack of suitalbe inspection instruments, the hesitancy to void the existing functional standards, and the lack of experience in the value of analytical measurements. It is evident that, because of increased demand for fine pitch gears and because of increased accuracy requirements, much consideration should be given to the benefits of analytical inspection.

The interpretation of size and runout gained either functionally or analytically are in all but the most critical conditions, close enough to be considered identical.